

# The Kidney

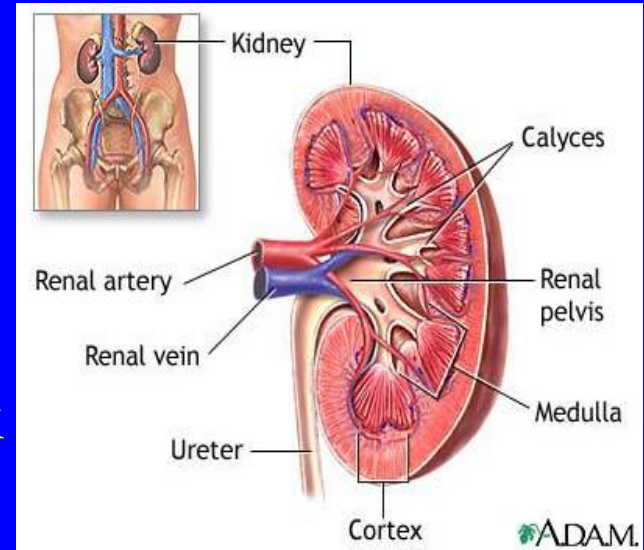
## Objectives:

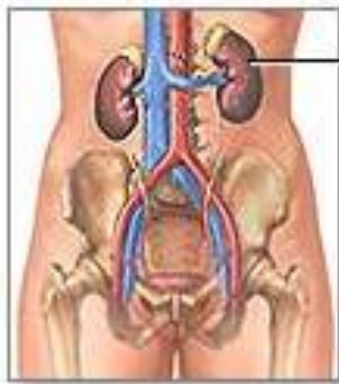
*By the end of this lecture, the student should be able to describe:*

1. The microscopic structure of the renal cortex and medulla.
2. The histology of renal corpuscle, proximal and distal tubules, loop of Henle, and collecting tubules & ducts.
3. The histological structure of juxtaglomerular apparatus.
4. The functional structures of the different parts of the kidney.

# KIDNEY

- Cortex: Dark brown and granular.
- Medulla: 6-12 pyramid-shape regions (renal pyramids)
  - The base of pyramid is toward the cortex (cortico-medullary border)
  - The apex (renal papilla) toward the hilum, it is perforated by 12 openings of the *ducts of Bellini* in region called area cribrosa. The apex is surrounded by a minor calyx.
  - **3 or 4 minor calyces** join to form 3 or 4 major calyces that form renal pelvis.
  - Pyramids are separated by cortical columns of Bertin.





Kidney

Renal artery

Renal vein

Ureter

Cortex

Calyces

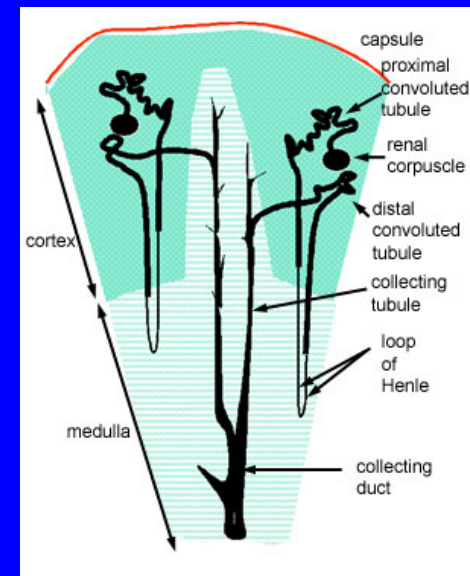
Renal  
pelvis

Medulla

ADAM.

**A hemisected  
view of the  
kidney**

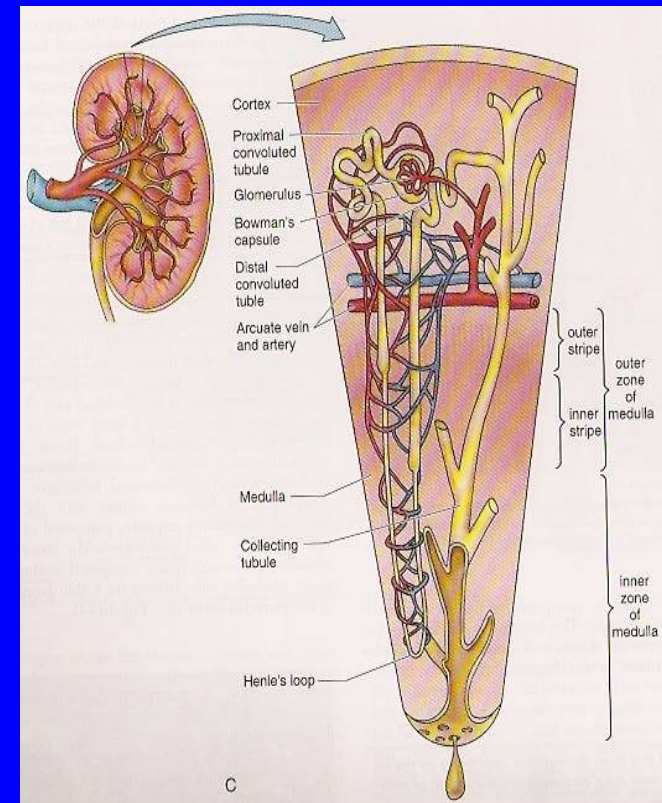
# Urineriferous tubule



- It is the functional unit of the kidney.
- Is formed of:  
*1- Nephron.*

## *2-Collecting tubule.*

- The tubules are densely packed.
- The tubules are separated by thin stroma and basal lamina.

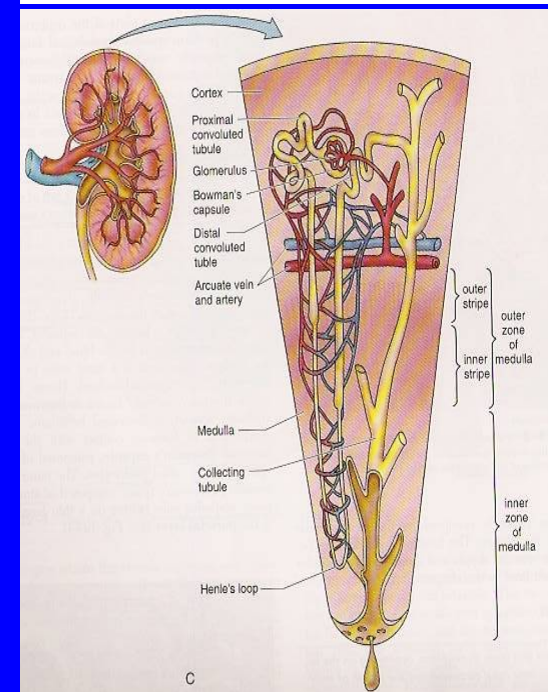
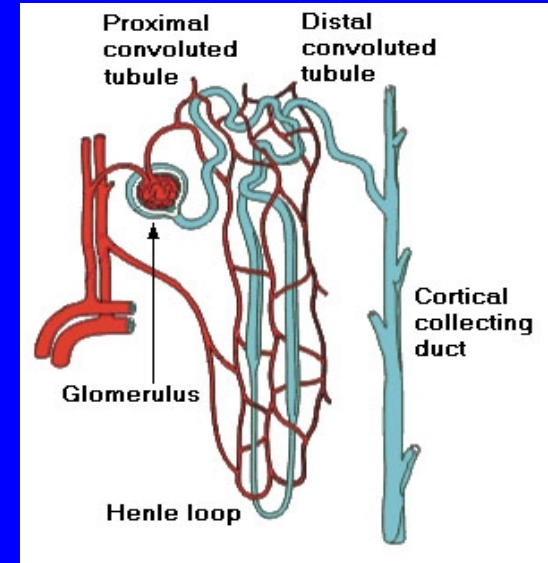
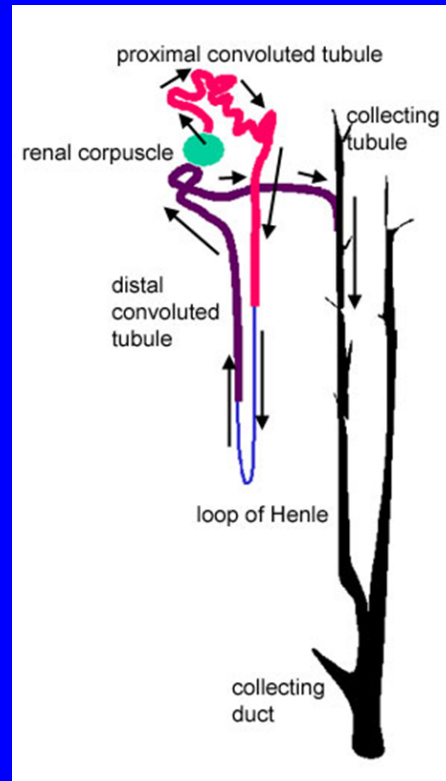


# Nephron

- There are 2 types of nephrons:
  - a- Cortical nephrons.
  - b- Juxtamedullary nephrons.

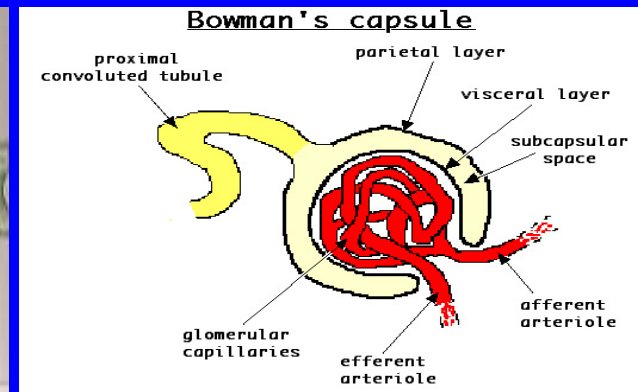
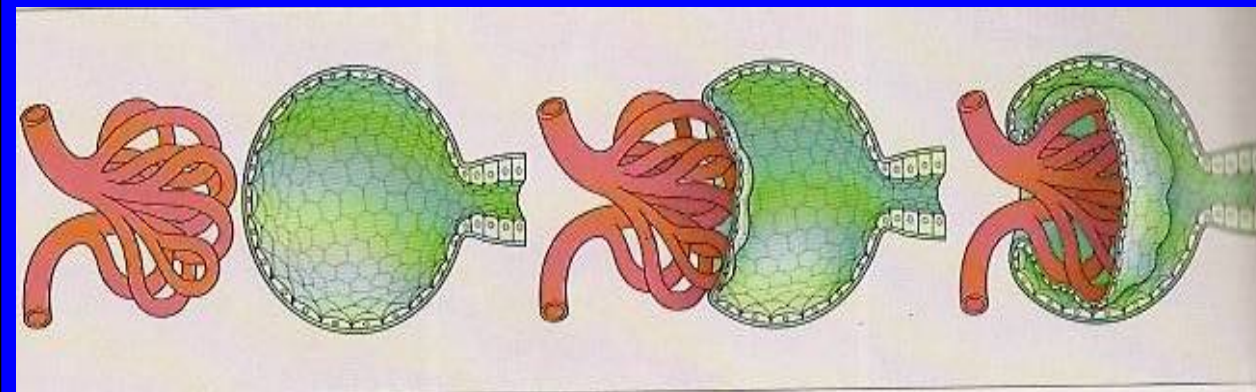
It is formed of :

- 1-Renal corpuscle.
- 2-Proximal tubule.
- 3-Thin limbs of Henle's loop.
- 4-Distal tubule

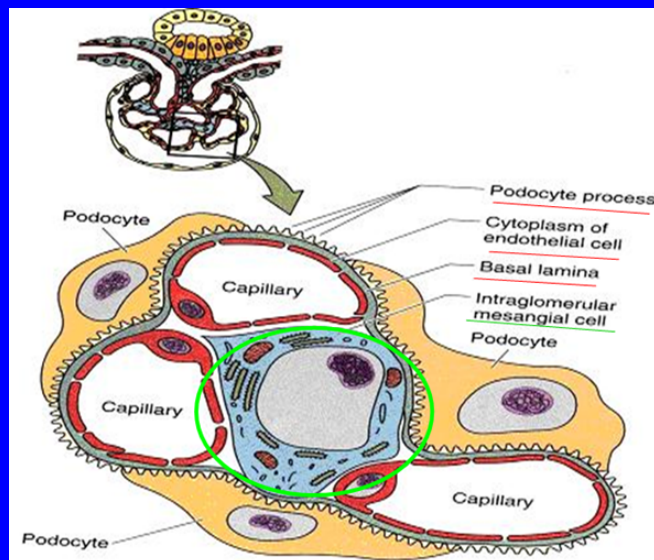
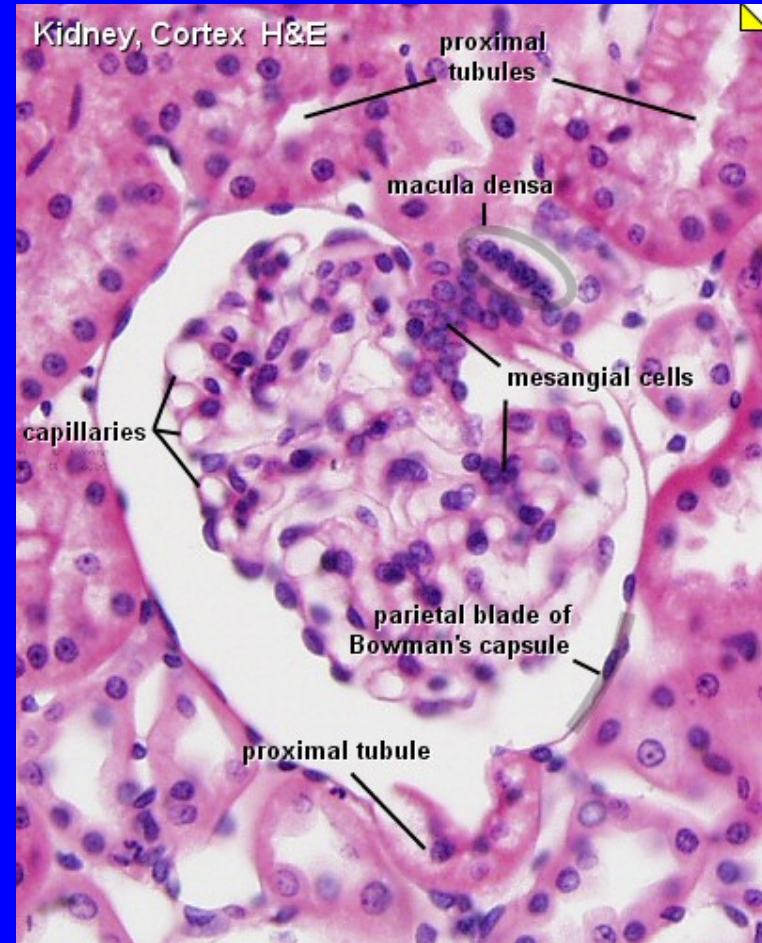
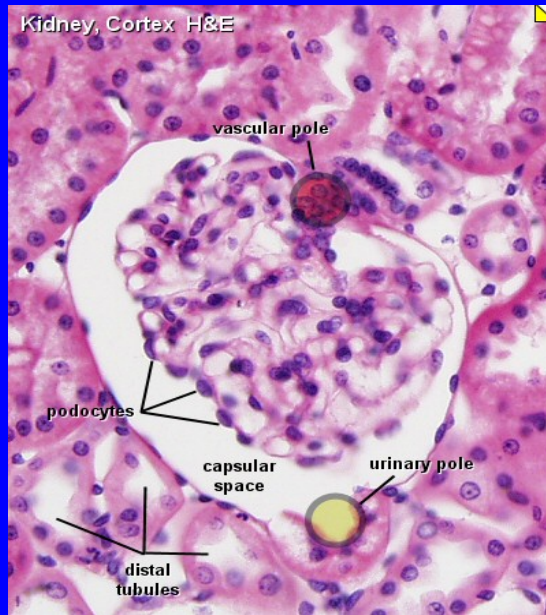


# Renal corpuscle

- **Glomerulus;** (tuft of fenestrated capillaries "without diaphragm")
- **Bowman's capsule;** (Parietal layer, urinary space and visceral layer or podocytes).
- **Mesangial cells;** (intra-glomerular cells).

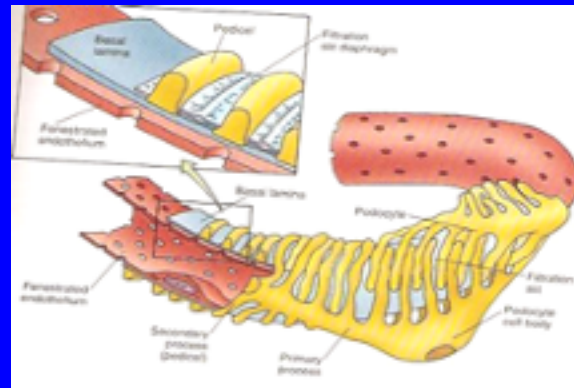
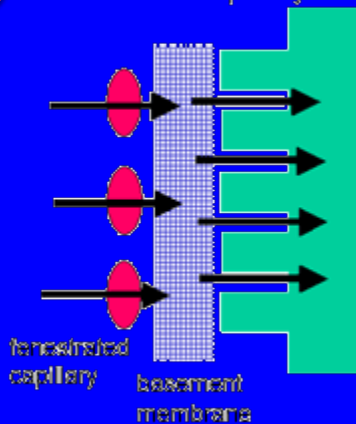


# Renal Corpuscle



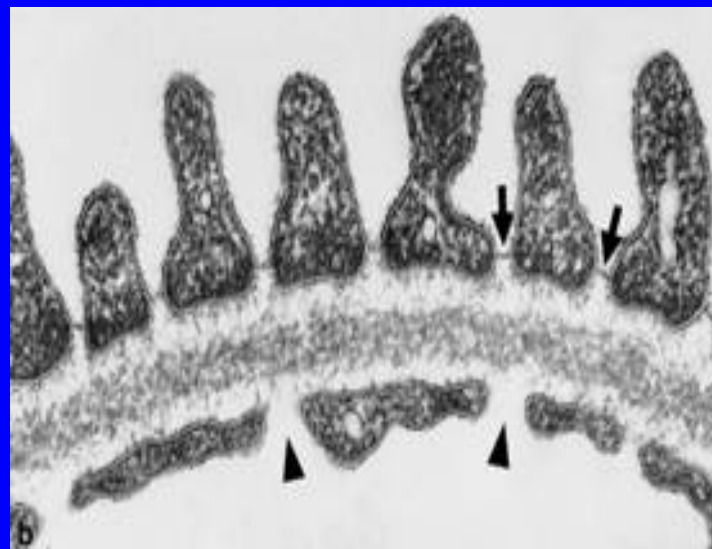
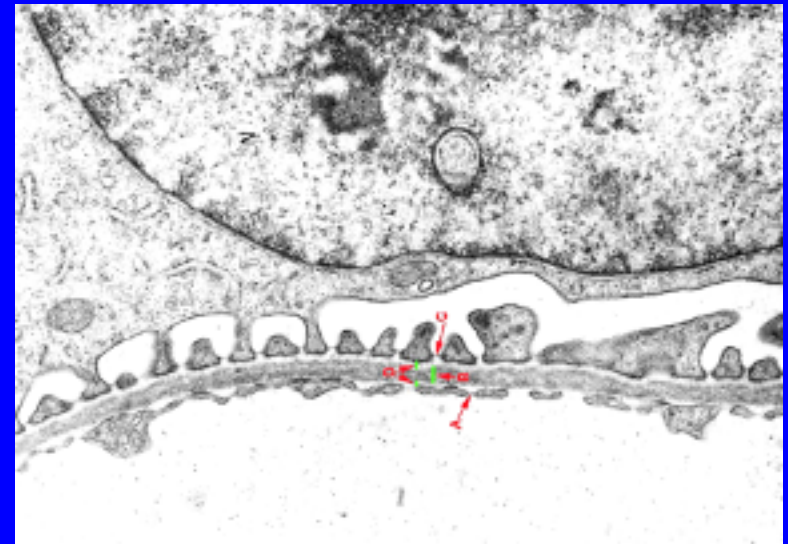
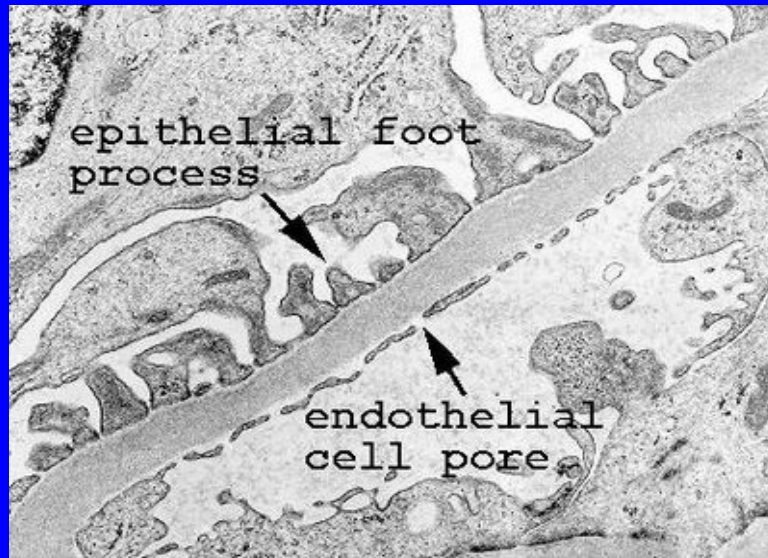
# Glomerular Filtration Barrier

- *Endothelial* wall of the glomerular capillaries.
- *The glomerular basal lamina* (inner and outer laminae rarae and middle lamina densa).
- Visceral layer of Bowman's capsule (*podocytes*)
- Podocytes have primary (major) processes and secondary (minor) processes (pedicles).
- Between pedicles (on the surface of capillaries) there are *filtration slits* that have *filtration slit diaphragms*.

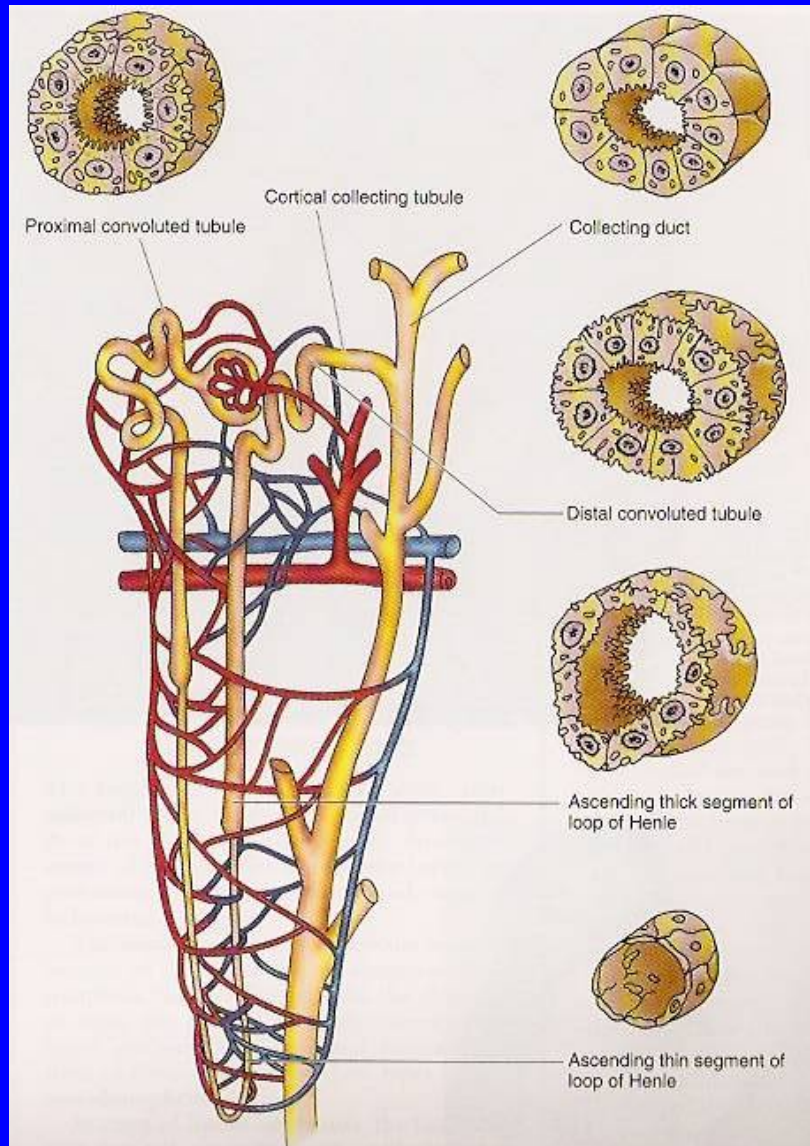




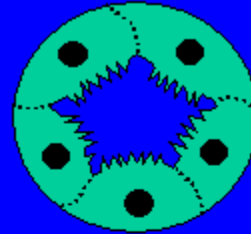
# Glomerular Filtration Barrier



# Renal tubules



proximal convoluted tubule



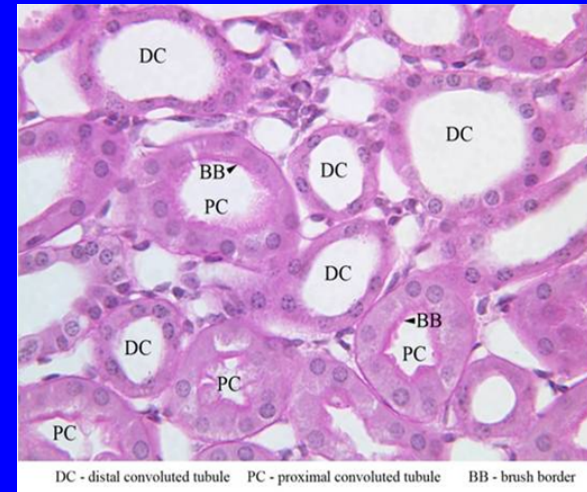
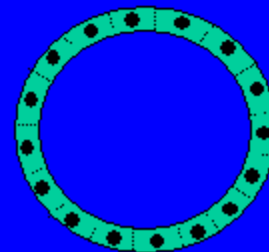
loop of Henle



distal convoluted tubule



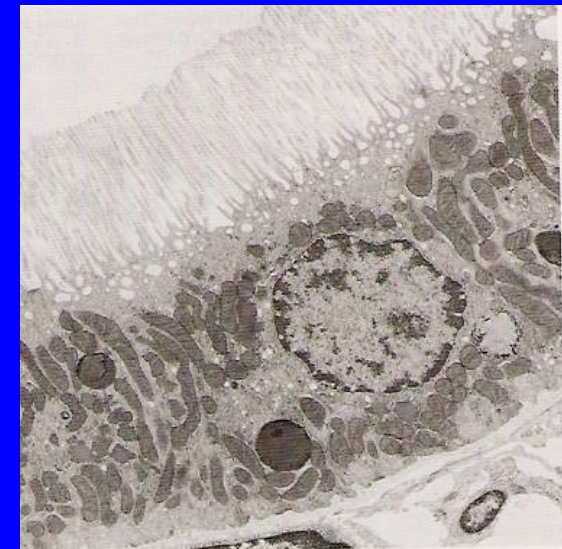
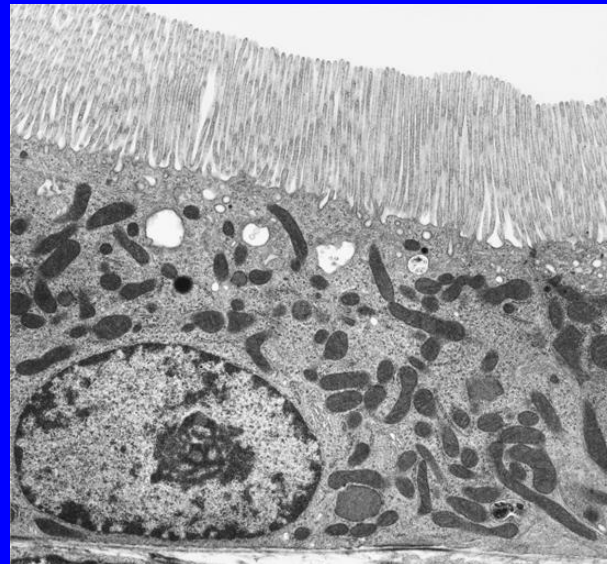
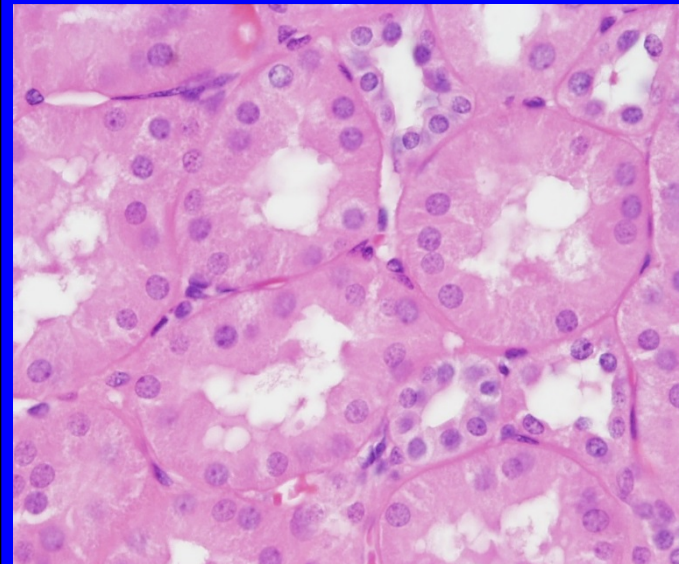
Collecting tubule



DC - distal convoluted tubule PC - proximal convoluted tubule BB - brush border

## *Proximal convoluted tubule*

- ❖ It is composed of simple cuboidal epith. with acidophilic cytoplasm. The cells have striated or brush border and lateral inter-digitations.
- ❖ They have well-defined basal lamina.



# Thin limbs of Henle's loop

- *It has 3 regions:*

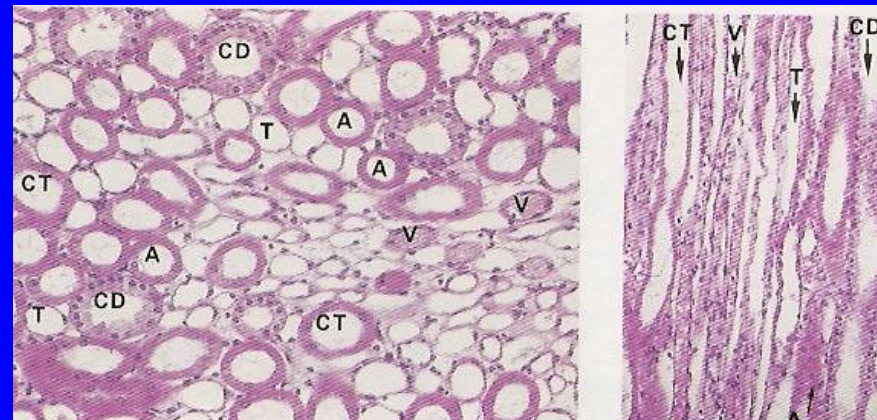
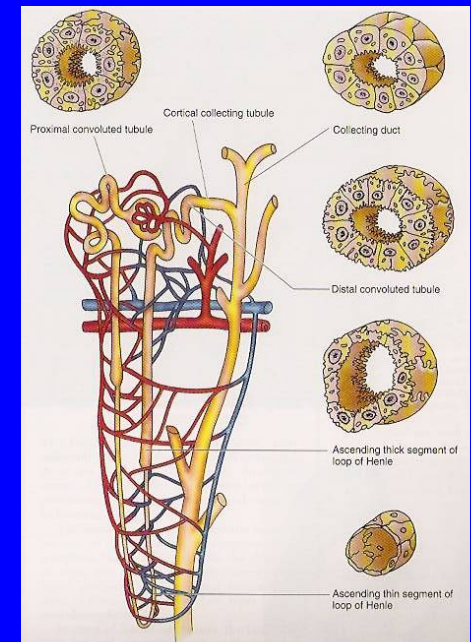
1-Descending thin limb.

2-Crest of Henle's loop.

3-Ascending thin limb.

NB. It is longer in juxta-medullary nephron than in cortical nephron.

\* It is composed of simple squamous epith.



# *Distal convoluted tubule*

It starts at the macula densa.

*macula densa* (tall columnar & narrow cells).

The Distal convoluted tubule is formed of low cuboidal epith.

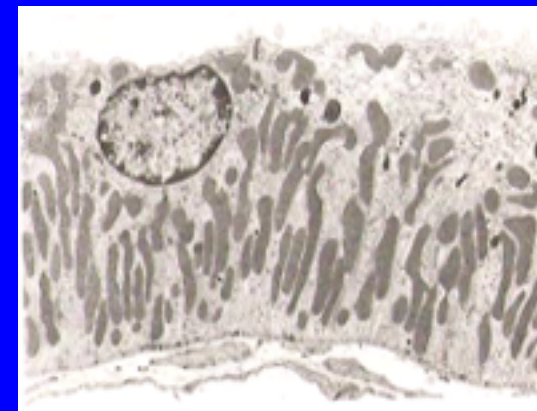
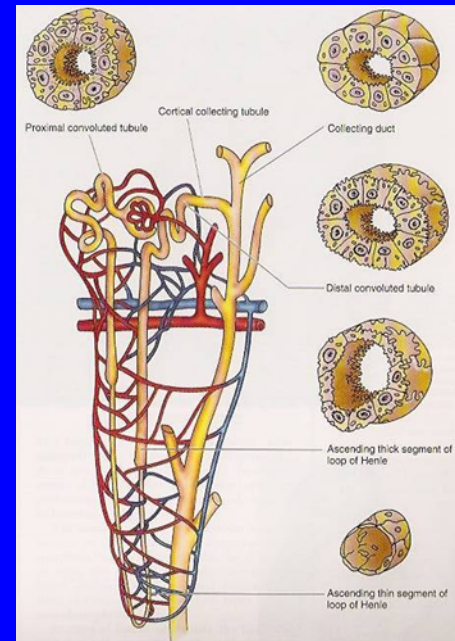
N.B. Because distal convoluted tubules are much shorter than proximal

convoluted tubules, any section of

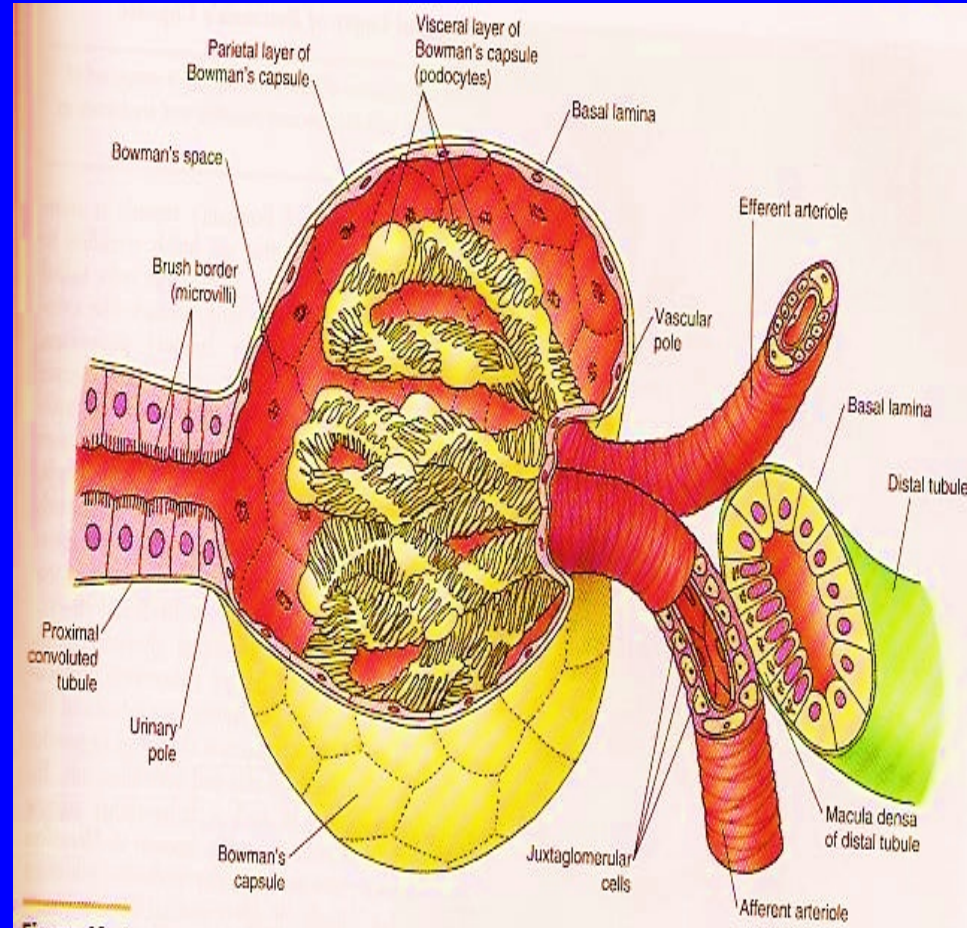
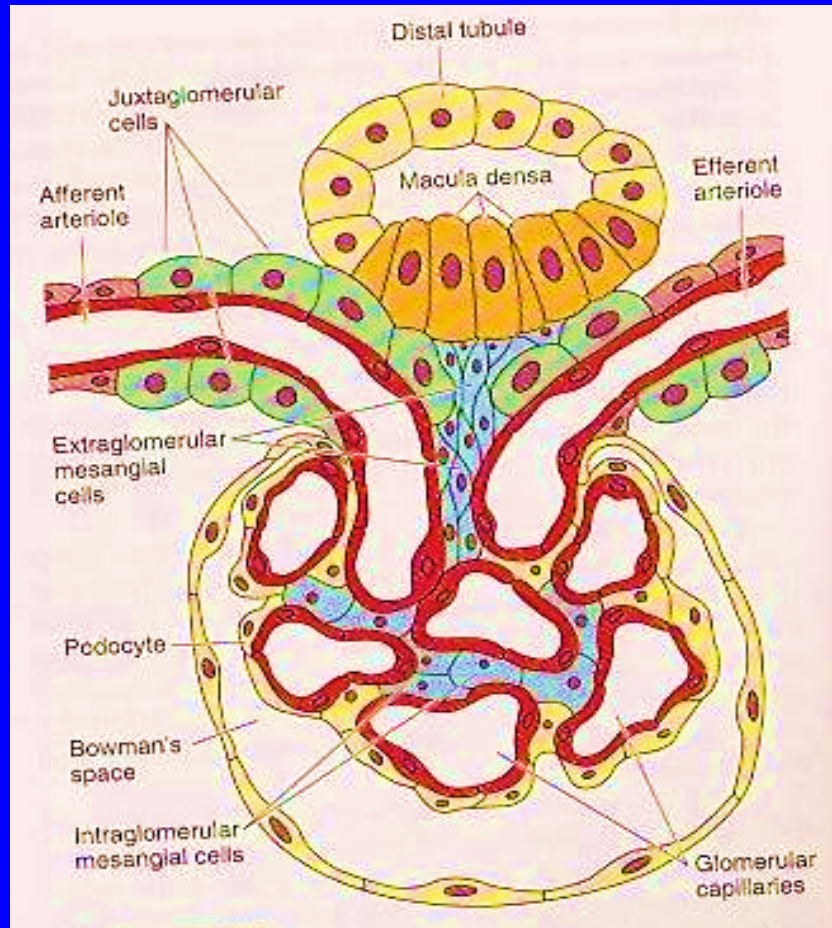
renal cortex presents many more

sections of proximal convoluted tubules.

\*Distal tubules drain into collecting tubules.



# Juxtaglomerular apparatus



## Juxtaglomerular apparatus

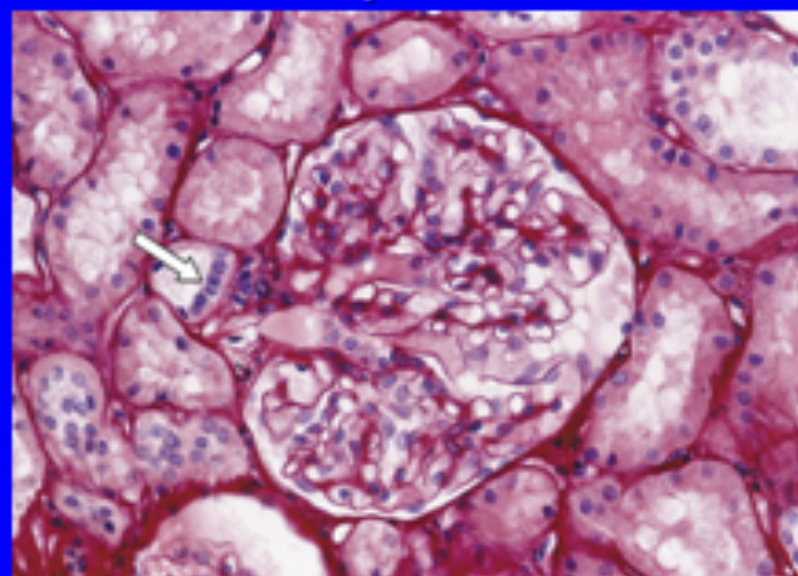
- It has 3 components:

**A-The macula densa** of distal tubule: Tall cells with centrally-placed nuclei

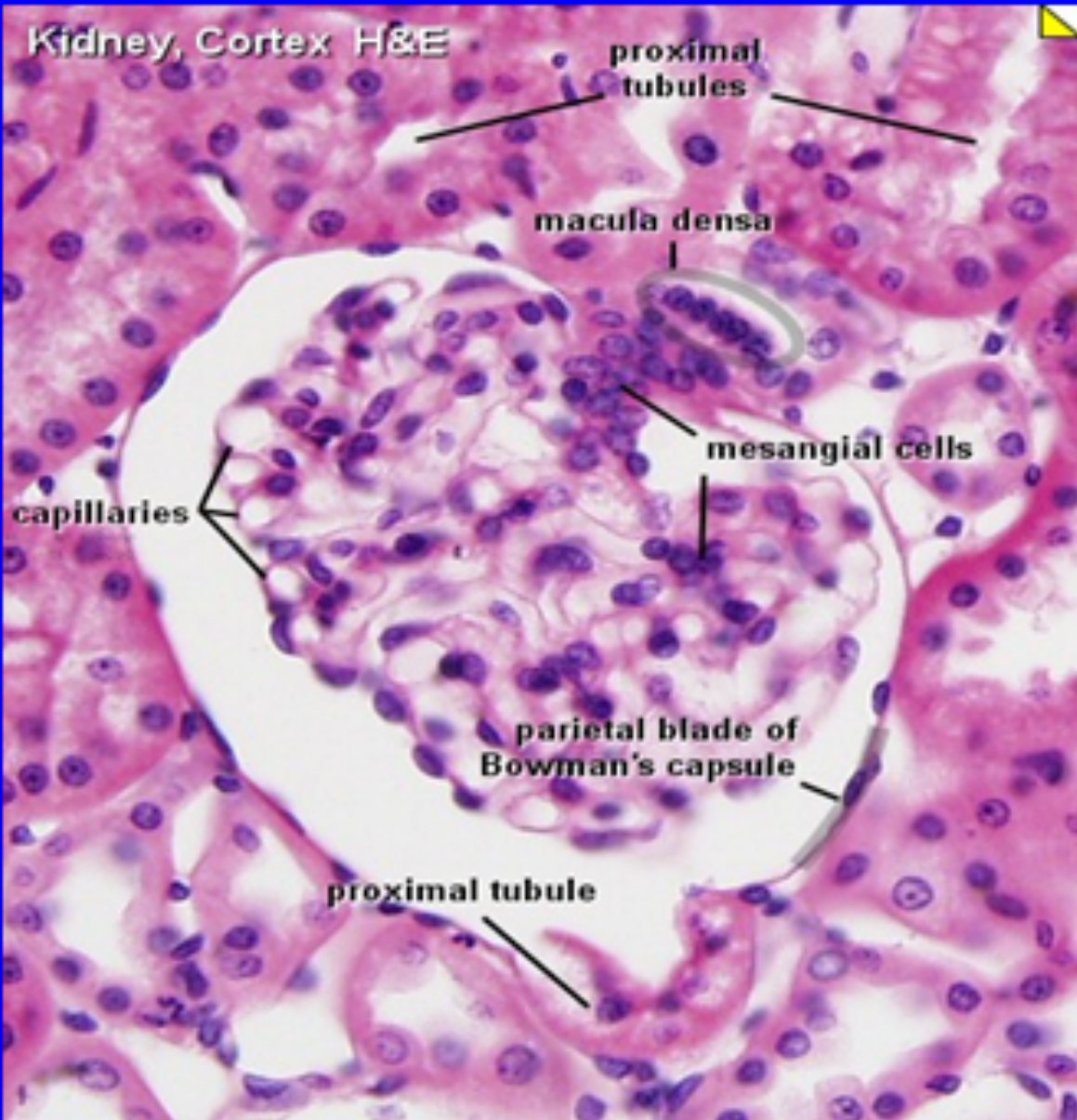
**B-Juxtaglomerular cells** of afferent glomerular arteriole (modified smooth muscle of tunica media). Nuclei are round with granular cytoplasm.

\*They secrete renin.

**C-The extraglomerular mesangial cells.**



Kidney, Cortex H&E





# *Collecting tubules*

- Are composed of simple cuboidal epithelium.
- They aren't part of nephron.
- They have 3 regions:

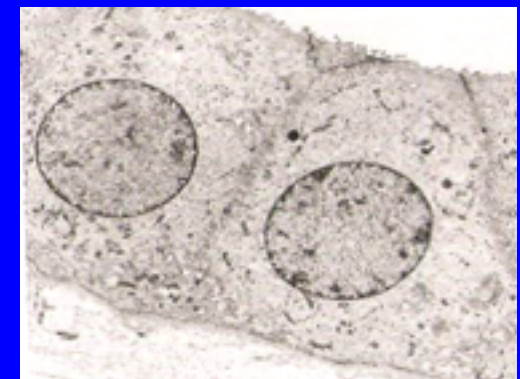
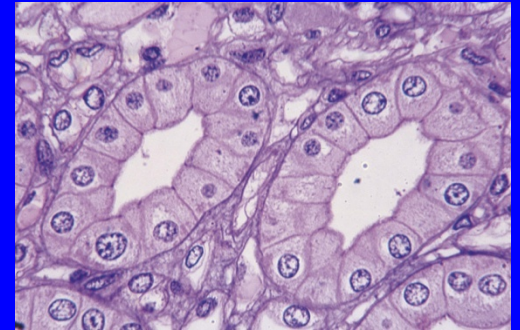
1-Cortical: **S. Cuboidal Epith.**

2-Medullary: **S. Cuboidal Epith.**

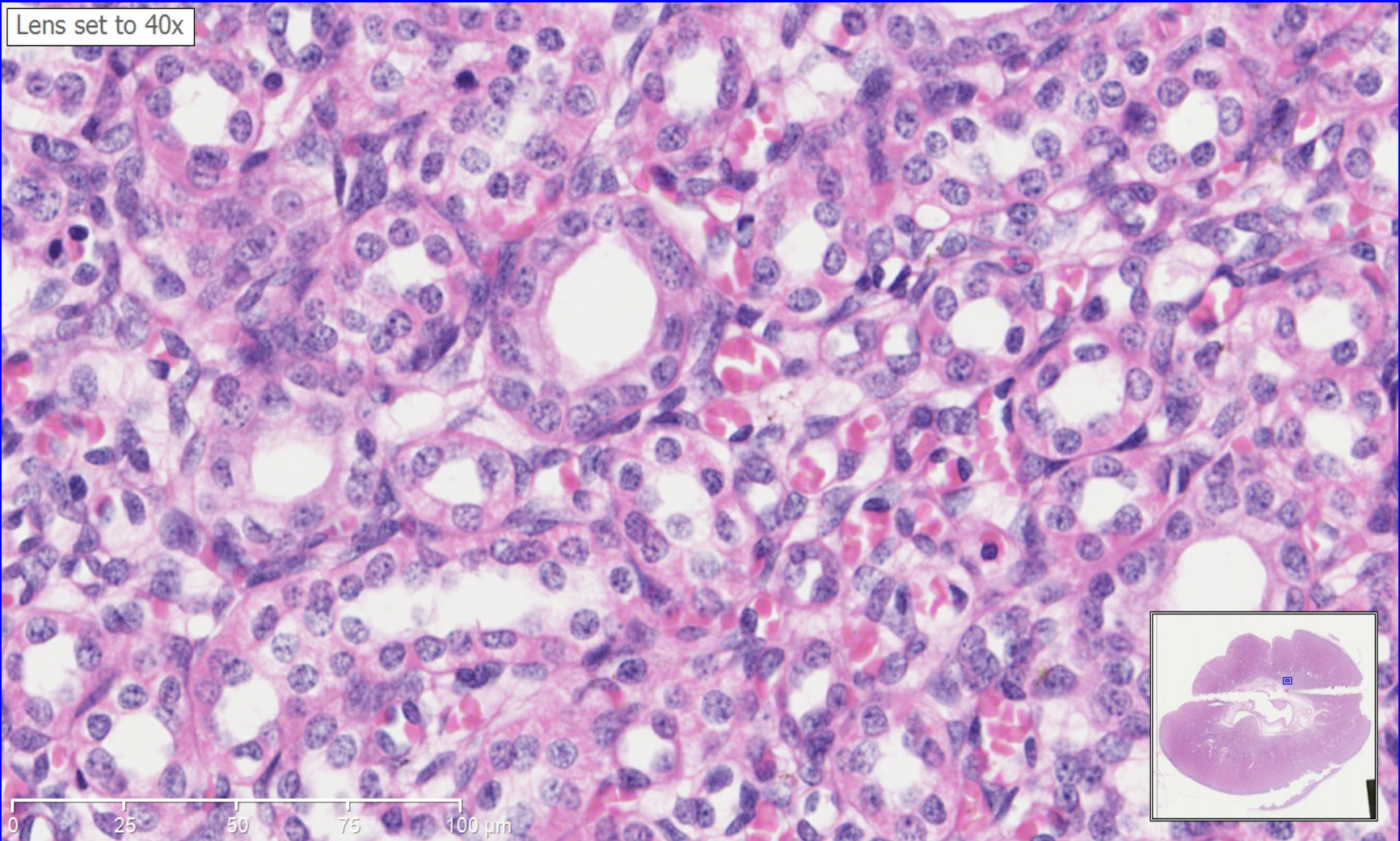
3-Papillary ducts (ducts of Bellini):  
**S. Columnar Epith.**

They open in area cribrosa.

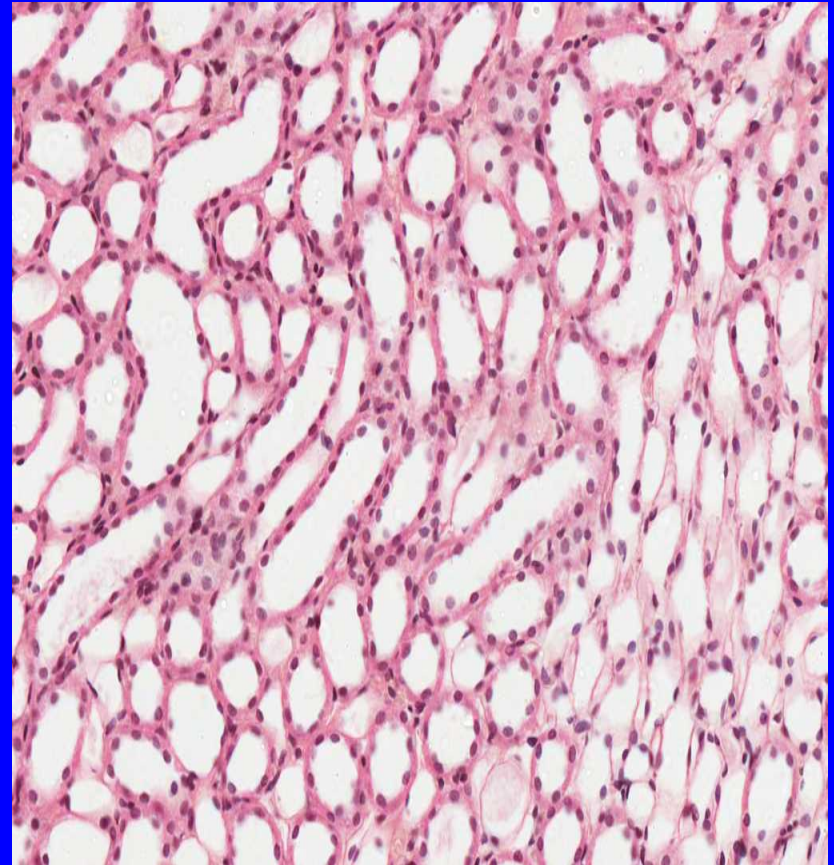
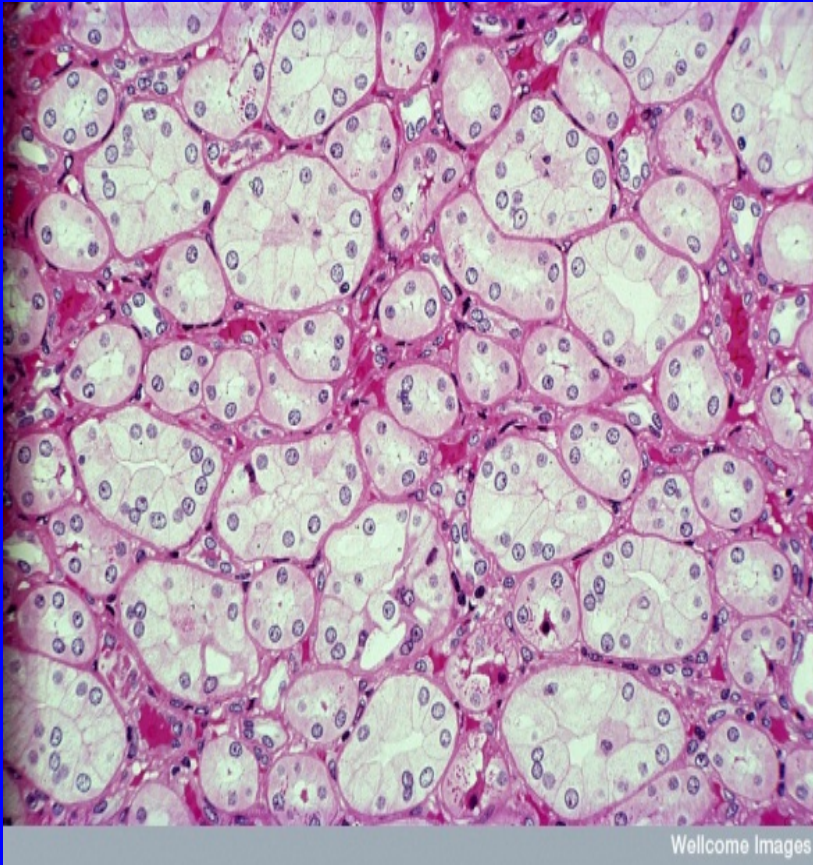
\*They are impermeable to water  
except in presence of ADH.



# MEDULLA OF THE KIDNEY



# MEDULLA OF THE KIDNEY



# *Renal interstitium*

- It is a very flimsy, scant amount of loose CT that contains:
- **1-Fibroblasts.**
- **2-Macrophages.**
- **3-Interstitial cells:** They secrete medullipin I, which is converted in the liver into medullipin II, that lowers blood pressure.

*BEST WISHES*